



KANE ENGINEERING LABORATORIES

845 Commercial Street • Palo Alto, California
Telephone (415) 321-2487 • TWX 415-492-9478

TECHNICAL DATA



Model KEL 600 DC to 10 kc
Model KEL 601 DC to 200 kc

- Excellent logarithmic response over wide dynamic range
- High input impedance
- Flat frequency response within stated range
- Compact size
- Entirely self-contained, employing long life batteries

LOGARITHMIC VOLTAGE COMPRESSOR

SIZE: 3 $\frac{3}{4}$ x 3 $\frac{1}{2}$ x 3 inches

WEIGHT: 20 oz.

CONNECTORS: BNC Jacks

DELIVERY: From stock to one month

PRICE: Model KEL 600 \$ 95.00

Model KEL 601 \$140.00

TERMS: Net 30 days, f.o.b. Palo Alto

Applications of the instrument include:

- transient measurements of wide dynamic range,
- conversion of voltmeters, oscilloscopes or recorders to a linear decibel scale,
- extension of useful dynamic range of magnetic tape and chart recorders as well as telemetering transmission systems,
- compression of dynamic range of signals for easy recording or plotting,
- display of exponential rise and decay functions as straight lines. Measurement of exponential functions,
- analog multiplication or division of voltages by means of addition or subtraction of their logarithms.

Logarithmic voltage compressors are particularly useful in conjunction with recorders and oscilloscopes. They convert any linear amplifier into a logarithmic amplifier.

Logarithmic voltage compressors are non-linear voltage divider circuits to produce an output voltage proportional to the logarithm of the input voltage. Solid state non-linear elements with good thermal stability are employed.

Model KEL 601 consists of a logarithmic voltage compressor circuit similar to KEL 600 supplemented by a high-stability, d-c coupled emitter follower. This two transistor printed circuit amplifier transforms the output impedance of the logarithmic voltage compressor to a value below 1000 ohms. The instrument is thus suitable for use with lower impedance devices. In particular, adverse effects due to capacitance loading at high frequencies are avoided. The instruments contain a size C flashlight battery as bias supply. In addition, Model KEL 601 contains one P6 Burgess 9-volt battery to energize the transistor amplifier. Batteries are easily replaceable. Each unit is shipped with individual calibration curve and operating instruction sheet.

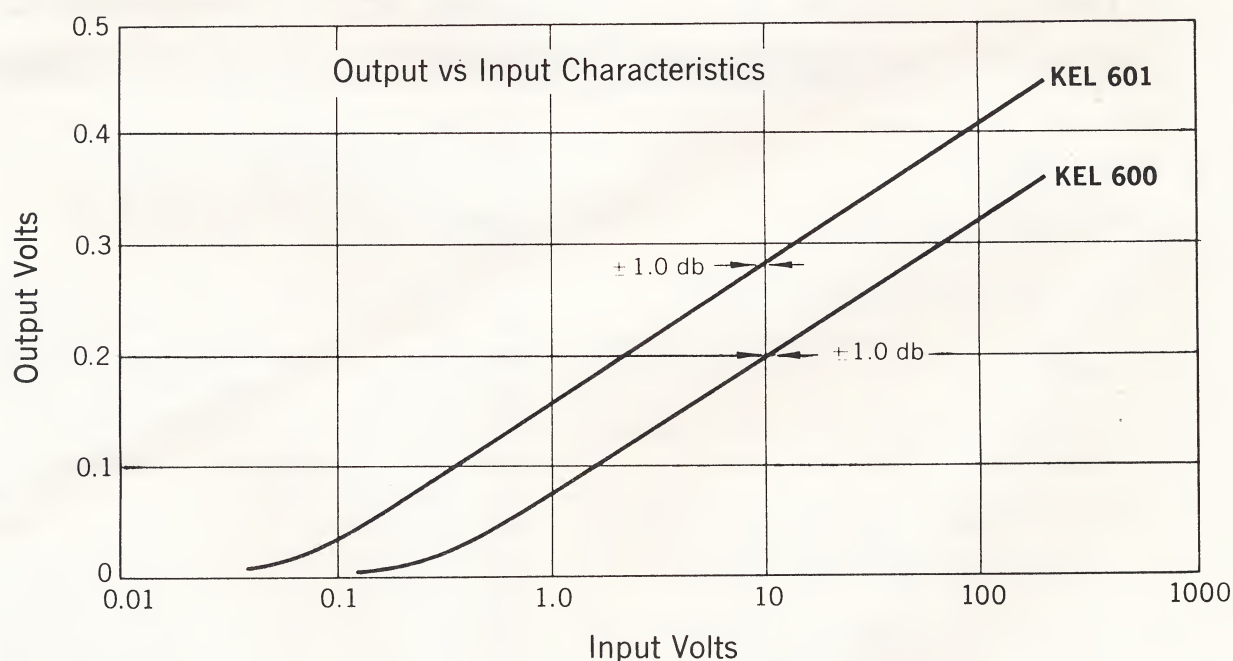
Contact KEL regarding units engineered to special requirements.

See reverse side for detailed specifications.

DETAILED TECHNICAL SPECIFICATIONS



	Model KEL 600	Model KEL 601
Frequency	d-c to 10 kc	d-c to 200 kc
Linear Dynamic Range	60 db (0.3-300 V peak)	60 db (0.1-100 V peak)
Linearity typical Minimum Spec.	± 0.5 db ± 1.0 db	± 0.5 db ± 1.0 db
Input Impedance	900 k Ω	200 k Ω
Output Impedance	80 k Ω at 0.3 V input 1 k Ω at 100V input	1 k Ω , max.
RMS output noise voltage	30 μ v	70 μ v
Useful Battery Life	500 hours, approx.	500 hours, approx.



TECHNICAL NOTES:

The above output characteristics are drawn in terms of instantaneous voltage values of a random time function. The rise times occurring in this function should of course be commensurate with the specified band width. The subject output characteristics are valid for signals of positive or negative polarity. Within the linear dynamic range they are expressed analytically by

$$V_{out} = 0.077 + 0.12 \log_{10} V_{in} \quad (\text{for KEL 600})$$

$$V_{out} = 0.16 + 0.12 \log_{10} V_{in} \quad (\text{for KEL 601})$$

For signals smaller than the low end of the dynamic range the Log. Voltage Compressors approach linear attenuator characteristics given by

$$V_{out} = 0.07 V_{in} \quad (\text{for KEL 600})$$

$$V_{out} = 0.3 V_{in} \quad (\text{for KEL 601})$$

Ambient temperature variations cause a change in output voltage of approximately -2 millivolts per degree C. This is constant over the dynamic range, so that the linearity remains preserved with the exception of a loss in dynamic range at the low end when working at elevated temperatures. For applications involving considerable temperature changes and requiring accurate and absolute calibration, it is recommended to apply a temperature correction to the output reading of the Log. Voltage Compressor. Two millivolts should be added for each degree C that the ambient temperature exceeds that indicated on the individual calibration curve furnished with the unit.



Model KEL 603
10 cps to 300 kc

- Excellent logarithmic response over wide dynamic range
- High input impedance
- Flat frequency response within stated range
- Compact size
- Entirely self-contained, employing long life batteries

LOGARITHMIC AMPLIFIER

SIZE: 3 $\frac{3}{4}$ x 3 $\frac{1}{2}$ x 3 inches

WEIGHT: 20 oz.

CONNECTORS: BNC Jacks

Applications of the instrument include:

- transient measurements of wide dynamic range,
- conversion of voltmeters, oscilloscopes or recorders to a linear decibel scale,
- extension of useful dynamic range of magnetic tape and chart recorders as well as telemetering transmission systems,
- compression of dynamic range of signals for easy recording or plotting,
- display of exponential rise and decay functions as straight lines. Measurement of exponential functions,
- analog multiplication or division of voltages by means of addition or subtraction of their logarithms.

Logarithmic amplifiers are particularly useful in conjunction with recorders and oscilloscopes.

DELIVERY: From stock to 30 days

PRICE: Model KEL 603 \$240.00

TERMS: Net 30 days, f.o.b. Palo Alto

KEL Logarithmic amplifiers are non-linear amplifying devices producing an output voltage proportional to the logarithm of the input voltage. Solid state non-linear elements with good thermal stability are employed.

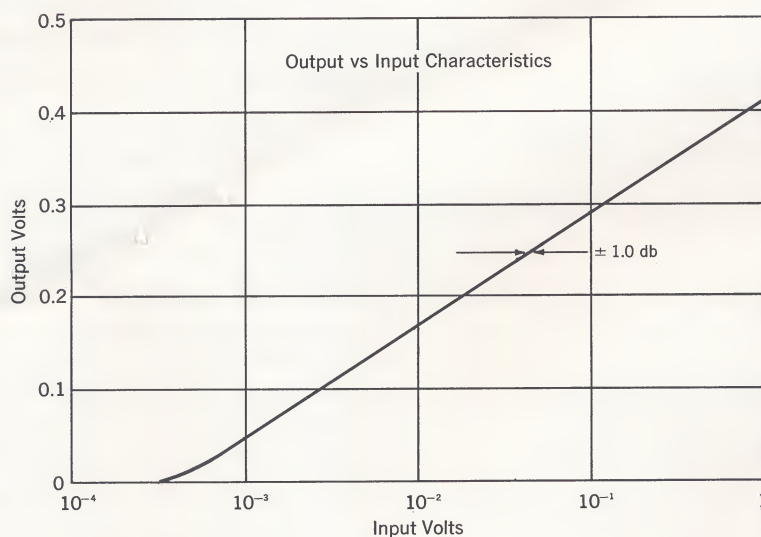
Model KEL 603 consists of a three-transistor, high input-impedance amplifier followed by the logarithmic voltage conversion unit, whose output voltage is fed through a two-stage emitter follower to obtain a low output source impedance of 100 ohm. The instrument is thus suitable to drive fairly low impedance loads, in particular, adverse effects due to capacitance loading at high frequencies are avoided. The instrument contains a size C flashlight battery as bias supply and a 9-volt battery (Burgess P6 or equivalent) to energize the transistor amplifiers. The batteries are easily replaceable. Each unit is shipped with individual calibration curve and operating instructions.

Contact KEL regarding units engineered to special requirements.

See reverse side for detailed specifications.

SPECIFICATIONS

Frequency response	± 0.2 db, 10 cps — 300 kc
Linear Dynamic Input Range	60 db (1 mv — 1 v peak)
Accuracy of logarithmic conversion Typical Min. spec.	± 0.5 db ± 1.0 db
Output range	0.05 — 0.41 v
Input impedance	1 meg ohm, shunted by 10 pf
Output impedance	100 ohm, max.
Max. d-c blocking voltage (max. safe input voltage)	30 v
RMS output noise voltage	200 μ v (with 1 k ohm source impedance)
Battery drain 1½ volt cell, size C 9 volt cell, Burgess P6 or equivalent	6 ma 5 ma
Useful battery life	100 hours, approx.



TECHNICAL NOTES:

The above output characteristic is drawn in terms of instantaneous voltage values of a random time function. The rise times occurring in this function should of course be commensurate with the specified band width. Within the linear dynamic range the characteristic is expressed analytically by

$$V_{out} = 0.41 + 0.12 \log_{10} V_{in}$$

There is a 180° phase reversal inherent in the instrument, i.e. positive input swings emerge as a logarithmically converted negative output swing, and vice versa.

Ambient temperature variations cause a change in output voltage of approximately —2 millivolts per degree C. This is constant over the dynamic range, so that the linearity remains preserved with the exception of a loss in dynamic range at the low end when working at elevated temperatures. For applications involving considerable temperature changes and requiring accurate and absolute calibration, it is recommended to apply a temperature correction to the output reading of the Log. Amplifier. Two millivolts should be added for each degree C that the ambient temperature exceeds that indicated on the individual calibration curve furnished with the unit.



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TECHNICAL DATA



Model KEL 505 Low output power
Model KEL 506 High output power

- Wide frequency response
- High input impedance
- Instantaneous recovery from overload
- Compact size
- Self-powered, employing 9 volt batteries
- Freedom from power-line interferences. No hum, no noise pick-up, no ground loop problems.
- Carefully engineered and tested
- Economically priced

WIDE BAND D-C TRANSISTOR AMPLIFIERS

SIZE: 3 3/4 x 3 1/2 x 3 inches

WEIGHT: 20 ounces

CONNECTORS: BNC Jacks

Applications of the instrument include:

- general laboratory use in electronic, chemical and aeronautical research and development; in medical and biological research.
- use as economical "utility" d-c amplifier to increase oscilloscope sensitivity; to drive chart recorders, x-y plotters, galvanometers, servo and control systems in the many applications where the expense of high precision, chopper stabilized d-c amplifiers is not justified.
- use as basic component in data transmission such as measurement of strain, pressure, flow rates, velocities, vibration, temperature and other physical quantities.
- adaptation of the dynamic range of the KEL logarithmic voltage compressors to lower voltages. Amplification of compressor output voltages.

Rackmounted multichannel units available on request. For amplifiers engineered to customer's requirements, call Kane Engineering Laboratories.

DELIVERY: From stock to 30 days

PRICE: Model KEL 505 \$250.00
Model KEL 506 \$290.00

TERMS: f.o.b. Palo Alto, Calif. Net 30 days

KEL wideband D-C amplifiers are high performance yet very economical instruments. Solid state devices and printed circuitry are packaged into an attractive, compact unit.

Carefully optimized circuitry, laid out in a clean, logical and reliable manner, assures accurate gain and low drift without resorting to expensive chopper stabilization. There is practically instantaneous recovery from overload voltages. Use is made of the well known advantages of negative feedback.

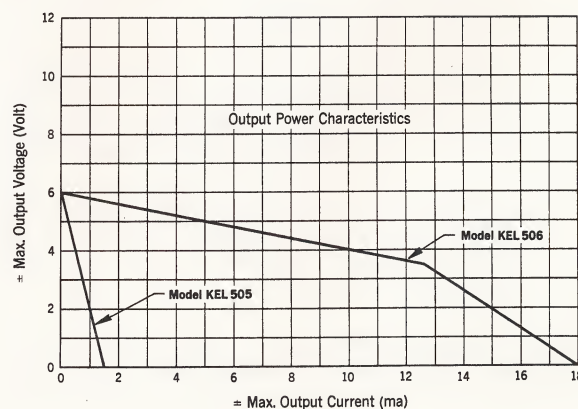
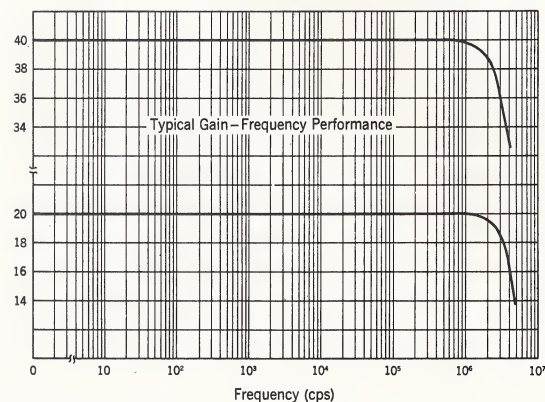
The units are powered by two 9 volt batteries. Small test jacks are provided on the front panel to allow convenient battery checks. The amplifiers are non inverting; i.e., positive input polarity yields positive output. A balance adjustment is provided to set zero output for zero input. A front panel switch permits the choice of two accurate, stable voltage gain values of 20 and 40 db. These gains are virtually independent of battery aging.

See reverse side for detailed specifications.

SPECIFICATIONS



	Model KEL 505 (Low output power)	Model KEL 506 (High output power)
Voltage Gain	20 or 40 db, switch selected, ± 0.5 db at d-c	
Gain Stability	± 0.2 db for 30% battery voltage droop	
Frequency Response	Flat within 0.5 db from d-c to 1 mc, down 3 db or less at 2 mc.	
Risetime	0.5 μ s	
Typical Phase Shift	3° at 10 kc 30° at 100 kc	
Maximum Output Voltage* (Clipping Level) *See also Output Power Characteristics plotted below.	± 6 volt (into open ckt.) ± 2 volt (into 1 ma load)	± 6 volt (into open ckt.) ± 2 volt (into 15 ma load)
Max. Output Impedance 20 db gain position 40 db gain position	700 Ohm 1000 Ohm	100 Ohm 100 Ohm
Min. Input Impedance 20 db gain position 40 db gain position	100 k ohm, shunted by 50 ρ f 60 k ohm, shunted by 50 ρ f	100 k ohm, shunted by 50 ρ f 60 k ohm, shunted by 50 ρ f
Max. Safe input Signal	5 Volt	
Linearity 20 db gain position (deviation from best straight line.) 40 db gain position	$\pm 0.5\%$ to ± 6 volt output $\pm 2.0\%$ to ± 6 volt output	$\pm 1.0\%$ to ± 5 volt output $\pm 3.0\%$ to ± 5 volt output
Equivalent rms Noise Voltage at Input (2 cps to 1 mc, 1 k ohm source impedance)	20 μ v	
Max. Equivalent Input Drift (1 k ohm source impedance)	± 500 μ v Total over 15° to 50° C Temperature Range	
Powered by	Two 9 volt batteries, Type P6	
Quiescent Battery Drain	3 ma	5 ma
Approximate Useful Battery Life	250 hours	150 hours





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TECHNICAL DATA



- Flat response over stated frequency range
- Battery operated, offering freedom from 60 cps hum, power line noise and ground-loop problems
- Good noise performance
- Bias-stable circuits

Model KEL 500 Audio/Low Input Impedance
Model KEL 501 Audio/High Input Impedance
Model KEL 503 Video/Low Input Impedance
Model KEL 504 Video/High Input Impedance

BATTERY POWERED TRANSISTOR AMPLIFIERS

SIZE: 3 $\frac{3}{4}$ x 3 $\frac{1}{2}$ x 3 inches

WEIGHT: 16 $\frac{1}{2}$ oz.

CONNECTORS: BNC Jacks

DELIVERY: 10 days

PRICE: Model KEL 500 \$100.00
Model KEL 501 110.00
Model KEL 503 105.00
Model KEL 504 120.00

Units unconditionally guaranteed for one year (exclusive of batteries).

Applications include:

- Sensitivity improvement of oscilloscopes, recorders, etc.
- Elimination of 60 cps hum, power line noise interference, ground-loop problems.

Kane amplifiers are compact, inexpensive units for general laboratory use. Powered by economical, long-life mercury batteries, they offer stable, humfree operation. Absence of power line noise interferences and ground loop problems are valuable characteristics.

The circuits employed are bias stable. Decrease in the maximum undistorted output signal is the only high temperature effect. Gain is virtually independent of temperature.

The effect of battery voltage droop is a corresponding decrease in peak output voltage with practically no influence on gain.

For other related amplifier requirements satisfying your particular needs, write to Kane Engineering Laboratories.

MODEL	AUDIO		VIDEO	
	KEL 500	KEL 501	KEL 503	KEL 504
Input impedance	4 k ohm	100 k ohm	1 k ohm (shunted by 130 $\mu\mu\text{f}$)	200 k ohm (shunted by 10 $\mu\mu\text{f}$)
Minimum bandwidth (-3 db points)	6 cps to 100 kc	6 cps to 100 kc	6 cps to 2 mc	6 cps to 2 mc
Minimum gain	40 db	35 db	40 db	30 db
Output impedance	8 k ohm	8 k ohm	2.7 k ohm	2.7 k ohm
Equivalent rms noise voltage at input	3 μv with 4 k ohm source impedance. 1.5 μv with input shorted.		6 μv with 1 k ohm source impedance. 1.5 μv with input shorted.	
Maximum d-c blocking voltage	12 v	400 v	12 v	100 v
Maximum p-t-p output voltage (clipping level)	6 v	6 v	6 v	6 v
Approximate useful battery life	3000 hrs	1500 hrs	3000 hrs	1500 hrs

